# GEOLOGICAL ENGINEERING (GE)

**GE F101 Introduction to Geological Engineering**
1 Credit
Offered Fall
Multiple aspects of geological engineering as a profession; the area and scope of the field.
**Lecture + Lab + Other:** 1 + 0 + 0

**GE F261 General Geology for Engineers**
3 Credits
Offered Spring
Study of common rocks and minerals, landforms and erosion. Geologic materials and engineering application of geology.
**Prerequisites:** MATH F151X; MATH F152X; Geology, science or engineering majors.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F322 Erosion Mechanics and Conservation**
3 Credits
Offered As Demand Warrants
Engineering mechanics of water and wind erosion processes, types of geologic or anthropogenic induced erosion, application of engineering principles for design, management and control of erosion and engineering analysis of conservation structures.
**Prerequisites:** ES F341.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F365 Geological Materials Engineering**
3 Credits
Offered Fall
Identification and classification of soils, physical and mechanical properties of soil, interaction of soils with subsurface water, subsurface exploration and case studies with an emphasis on permafrost.
**Prerequisites:** ES F208; GE F261.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F371 Remote Sensing for Engineering**
3 Credits
Offered Spring
Applications of remote sensing to geological engineering problems. Introduction to digital satellite image processing with hands-on practice.
**Prerequisites:** PHYS F212X.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F375 Principles of Engineering Geology and Terrain Analysis**
3 Credits
Offered Fall
Evaluation of terrain characteristics using basic geomorphic and engineering principles. Alaskan applications are provided due consideration.
**Prerequisites:** GE F261.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F376 GIS Applications in Geological and Environmental Engineering**
3 Credits
Offered Spring Odd-numbered Years
Fundamentals, concepts and components of geographic information systems (GIS) in engineering design. Introduction to acquiring, manipulating and analyzing digital terrain data for geological engineering and environmental applications, and the assessment of mineral resources. NRM F338 Recommended.
**Prerequisites:** GE F261; GE F375.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F381 Field Methods and Applied Design I** (W)
2 Credits
Offered Summer
Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.
**Prerequisites:** WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F320; GEOS F314.
**Lecture + Lab + Other:** 0 + 9 + 3

**GE F382 Field Methods and Applied Design II** (W)
4 Credits
Offered Summer
Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.
**Prerequisites:** WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F320; GEOS F314.
**Lecture + Lab + Other:** 0 + 9 + 0

**GE F384 Engineering Geology of Alaska** (a)
4 Credits
Offered Summer
A survey of the geology of Alaska relevant to the definition of natural and human-induced geological engineering hazards, the evaluation of sources of and specifications for engineering materials, and the evaluation of engineering construction sites.
**Prerequisites:** Upper-division standing.
**Lecture + Lab + Other:** 3 + 1 + 2

**GE F400 Geological Engineering Internship**
1-3 Credits
Offered Summer
Supervised work experience in engineering organizations. Assignments will be individually arranged with cooperating organizations from the private and public sectors. A report of activities must be completed and reviewed by the sponsoring organization. The report may be held in confidence at the request of the sponsoring organization.
**Prerequisites:** Upper-division standing.
**Lecture + Lab + Other:** 1-3 + 0 + 0

**GE F405 Exploration Geophysics**
3 Credits
Offered Fall
Theory and application of gravity, magnetic, electrical, electromagnetic, radioactive and seismic methods as used for geophysical exploration. Some field work.
**Prerequisites:** GE F375; MATH F251X; PHYS F211X.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F420 Subsurface Hydrology**
3 Credits
Offered Fall
Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water.
**Prerequisites:** GE F365; MATH F302; ES F341.
**Stacked with** GE F610.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F422 Soil Physics** (a)
3 Credits
Offered As Demand Warrants
Fundamentals of soil physics, including soil texture, structure, size distribution, and water retention characteristics; flow of water through saturated and unsaturated soil; soil temperature and heat flow; infiltration, runoff, and evaporation. Processes relevant to active layer dynamics and permafrosts are given due consideration.
**Prerequisites:** CHEM F105X, CHEM F106X.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F430 Geomechanical Instrumentation**
3 Credits
Offered As Demand Warrants
Measurement of groundwater pressure, ground deformation, stress and temperature as well as the planning of monitoring programs, instrument calibration, maintenance and installation, data collection, interpretation, and reporting. Case histories are used.
**Prerequisites:** ES F331; GE F261 or GEOS F101X.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F435 Exploration Design**
3 Credits
Offered As Demand Warrants
Geologic, engineering and economic considerations applied to the design and development of mineral exploration programs.
**Prerequisites:** GEOS F314.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F440 Slope Stability**
3 Credits
Offered Fall Odd-numbered Years
Slope design for open pit mining and other excavations. Stability analysis by various methods and on-site measuring and monitoring techniques.
**Prerequisites:** ES F331.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F441 Geohazard Analysis**
3 Credits
Offered Fall Even-numbered Years
Procedures and techniques to evaluate geological factors for geohazards, such as landslides, earthquakes, volcanoes, flooding, coastal hazards and permafrost-related problems.
**Prerequisites:** GE F365.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F445 Design of Earth Dams and Embankments**
3 Credits
Offered Fall Odd-numbered Years
Preliminary planning for design and construction of dams, site selection, reservoir assessment, foundation and other building materials, procedure for design of earth dams, design of abutment and spillway, estimation of volume of earthworks and storage capacities, site preparation for construction, excavation, slope stability issues and other geological engineering assessments.
**Prerequisites:** senior standing.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F480 Senior Design** (W)
3 Credits
Offered Spring
Design factors and procedures for the solution of geological engineering problems. A design project is the focus of the course.
**Prerequisites:** WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; senior standing in the geological engineering program with completion of GE F261; GE F365; GE F371; GE F375; GE F381; GE F382; GE F405; GE F420.
**Lecture + Lab + Other:** 1 + 6 + 0

**GE F610 Subsurface Hydrology**
3 Credits
Offered Fall
Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water.
**Prerequisites:** Graduate standing in Engineering.
**Stacked with** GE F420.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F620 Advanced Groundwater Hydrology**
3 Credits
Offered As Demand Warrants
Study of groundwater hydrology with emphasis on solute and contaminant transport, chemical reaction and ion exchange, advection and diffusion and computer modeling.
**Prerequisites:** GE F610; graduate standing.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F622 Advanced Soil Physics** (a)
3 Credits
Offered As Demand Warrants
Fundamentals of soil physical processes, multiphase flow, heat transfer and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geo-environmental and geotechnical problems. Characterization of hydraulic properties in relation to soil physical parameters in the context of geoengineering problems of flow, transport and stability.
**Prerequisites:** GE F610 and Graduate standing in Engineering.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F624 Stochastic Hydrology and Geohydrology**
3 Credits
Offered As Demand Warrants
Overview of the stochastic methods used to study and analyze hydrolic and geohydrolic processes. Emphasis on modeling hydrolic processes using statistical methods and stochastic interplay of processes between surface and subsurface hydrology.
**Prerequisites:** GE F620 and graduate standing in Engineering.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F626 Thermal Geotechnics**
3 Credits
Offered As Demand Warrants
Fundamentals of thermal regimes of soils and rocks. Thermal impact of structures on soils. Thawing of permafrost beneath roads, buildings and around pipelines. Natural and artificial freezing of soils. Engineering means to maintain thermal regime of soils. Thermal design considerations.
**Prerequisites:** CE F326; CE F422.
**Cross-listed with** CE F626.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F635 Advanced Geostatistical Applications**
3 Credits
Offered As Demand Warrants
Introduction to the theory and application of geostatistics. Review of classical statistics, continuous and discrete distributions, hypothesis testing and global estimation. Presentation of fundamental geostatistical concepts including: variogram, estimation variance, block variance, kriging, geostatistical simulation. Emphasis on the practical application of geostatistical techniques.
**Prerequisites:** MIN F408; graduate standing.
**Cross-listed with** MIN F635.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F665 Advanced Geological Materials Engineering**
3 Credits
Offered As Demand Warrants
In-depth study of geological materials (aggregates--sand, gravel and crushed rock for construction purposes) exploration, evaluation, testing and production. Emphasis placed on geological materials used for construction in Arctic and sub-Arctic environments, economic analysis of pit and quarry operations and availability of materials in Alaska.
**Prerequisites:** GE F365.
**Recommended:** MIN F408.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F666 Advanced Engineering Geology**
3 Credits
Offered As Demand Warrants
The interaction between geology and engineering case histories.
**Prerequisites:** GE F365; graduate standing.
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F668 Tunneling Geotechniques**
3 Credits
Offered As Demand Warrants
Tunnel design, case histories, student report.
**Prerequisites:** Graduate standing.
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F692 Graduate Seminar**
1 Credit
Topics in geological engineering explored through talks, group discussions and guest speakers with a high level of student participation.
**Prerequisites:** Graduate standing.
**Lecture + Lab + Other:** 1 + 0 + 0

**GE F692P Graduate Seminar**
1 Credit
Offered As Demand Warrants
Topics in geological engineering explored through talks, group discussions and guest speakers with a high level of student participation.
**Prerequisites:** Graduate standing.
**Lecture + Lab + Other:** 1 + 0 + 0

**GE F698 Non-thesis Research/Project**
1-9 Credits
**Lecture + Lab + Other:** 0 + 0 + 0

**GE F699 Thesis**
1-9 Credits
**Lecture + Lab + Other:** 0 + 0 + 0